भारतीय मानक
Indian Standard

IS 16939 : 2018
(Reaffirmed 2021)

अंदर परिसर (एफ़टीटीएक्स) के अनुप्रयोग के लिए रेशा और रेशा तंतु केबल

Optical Fibre Cables for Inside Premises (FTTx) Application

ICS 33.180

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भारतीय मानक ब्यूरो
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June 2018 **Price Group 5**

Fibre Optics, Fibres, Cables and Devices Sectional Committee, LITD 11

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards after the draft finalized by the Fibre Optics, Fibres, Cables and Devices Sectional Committee had been approved by the Electronics and Information Technology Division Council.

Presently, there is no ISO/IEC standard on this subject. However, this standard has been derived from TEC GR No. GR/OFC-019/01. FEB 2009 for optical fibre cable for fibre to home (FTTH) Application (G.657 A fibre) as a cost effective solution.

The objective of this standard is to lay down the material requirement, design and construction requirement, installation details and methods of tests for optical fibre cables for FTTH application.

Optical fibre cable to be used by multiple service operator is the new variety of cables replacing co-axial cables which is being used now and has many advantages over co-axial cables including cost effectiveness.

FTTH is the delivery of a communication signal over optical fibre, replacing existing copper infrastructure, such as telephone wires and coaxial cable. FTTH is a relatively new and fast growing method of providing vastly higher bandwidth to customers. Connecting homes directly to fibre optic cable enables enormous improvement in the bandwidth that can be provided to consumers. Current fibre optic technology can provide two-way transmission speeds of up to 100 megabits per second. Further, as cable modem and DSL providers are struggling to squeeze increment of higher bandwidth out of their technologies, ongoing improvement in fibre optic equipment are constantly increasing the available bandwidth without having to change the fibre. That’s why fibre networks are said to be “future proof.”

The services over FTTH are:

a) Basic internet Access Service controlled and uncontrolled from 256 Kbps to 1 000 Mbps. TV over IP service (MPEG2), video on demand (VoD) (MPEG4) play like VCR, audio on demand service
b) Bandwidth on demand (user and orf service configurable), remote education
c) Point to point and point to multi point video conferencing, virtual classroom
d) Voice and video telephony over IP: Connection under control of centrally located soft switches
e) Interactive gaming, VPN on broadband, dial up VPN Service, virtual private LAN service (VPLS)

The composition of the Committee responsible for the formulation of this standard is given in Annex E.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 ‘Rules for rounding off numerical values (*revised*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

FIBRE OPTIC CABLE FOR INSIDE (FTTx) PREMISES APPLICATION

1 SCOPE

1.1 This standard defines the requirements of single mode optical fibre cable, using optical fibre conforming to the ITU-T Rec.G.657, for FTTx applications. The optical fibre being used, is bend insensitive which is suitable for inside premises applications and typically to be used by Multiple Service Operator (MSO).

1.2 This will cover two different types of cable designs:

a) Type I — Indoor application (as per Annex A); and

b) Type II — Indoor/outdoor application in the premises (as per Annex B).

2 REFERENCES

The standards listed in Annex C and Annex D contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreement based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated in Annex C and Annex D.

3 GENERAL REQUIREMENTS

3.1 The design and construction of metal free optical fibre cable shall be inherently robust and rigid under all conditions of installation, operation, adjustment, replacement, storage and transport for FTTx application.

3.2 The fibre used in the cable shall be as per ITU-T G.657. A2 and G.657.B3.

3.3 The manufacturer shall submit an undertaking that the optical and mechanical fibre characteristics shall not change during the lifetime of the cable against the manufacturing defects.

3.4 Technical Requirements

Single mode optical fibre is used in manufacturing of optical fibre cables shall be as per ITU-T Rec.G 657.A2 and G.657.B3. The specification of optical fibre is mentioned below.

3.4.1 *Type of Fibre* — ITU-T G.657 A2

3.4.1.1 *Geometrical characteristics*

a) Mode field diameter (MFD) at 1 310 nm : [8.6 to 8.8] µm + 0.4 µm

b) Nominal cladding diameter : 125 µm ± 0.7µm

c) Cladding non-circularity : ≤ 0.8 percent

d) Core clad concentricity error : ≤ 0.5 µm

e) Diameter over primary coated with double UV cured acrylate : 242 µm ± 5 µm (uncolor);
252 µm ± 10 µm (color)

f) Coating/Cladding concentricity : ≤ 12 µm

3.4.1.2 *Transmission characteristics*

Cabled fibre attenuation

a) At 1 310 nm : ≤ 0.38 dB/km

b) At 1 383 nm : ≤ 0.38 dB/km

c) At 1 550 nm : ≤ 0.25 dB/km

NOTE — Point discontinuity in attenuation shall be less than 0.1 dB at 1 310 nm and 1 550 nm.

3.4.1.3 *Dispersion*

a) Zero dispersion slope : ≤ 0.092 ps/(nm^2 km)

b) Zero dispersion wave length range : 1300-1324 nm

c) Chromatic dispersion at 1550 nm : ≤ 18.0 ps/nm. Km

d) Polarization mode dispersion:
  1) Individual cabled fibre : ≤ 0.3 ps/√ km
  2) Link design value : ≤ 0.2 ps/√km

3.4.1.4 *Cable cut off wavelength* — ≤ 1 260 nm

3.4.1.5 *Mechanical characteristics*

3.4.1.5.1 *Proof test for minimum strain level* — 1 percent *(Test method IS/IEC 60793-1-30 : 2010)*

3.4.1.5.2 *Peak strip ability force to remove primary* — 1.3 ≤ F ≤ 8.9 N *coating of the fibre (Test method IS/IEC 60793-1-32 : 2010)*

3.4.1.5.3 *Dynamic tensile strength (Test method IS/IEC 60793-1-31 : 2010)*

a) Un-aged (Median value) : ≥ 550 KPSI (3.80 GPa)
b) Aged (Median value) : ≥ 440 KPSI (3.00 GPa)

3.4.1.5.4 *Dynamic fatigue ((Test method IS/IEC 60793-1-33 : 2001, method A/B))* — ≥ 20

3.4.1.5.5 *Static fatigue (Test method IS/IEC 60793-1-33 : 2001)* — ≥ 20

3.4.1.5.6 *Fibre curl (Test method IS/IEC 60793 1-34 : 2006)* — ≥ 4 M

3.4.1.6 *Environmental characteristic of fibre*

3.4.1.6.1 *Operating temperature (Test Method IS/IEC 60793-1-1 :2008)*

a) Temperature dependence of attenuation : – 60°C to + 85°C
b) Induced attenuation at 1 310 nm and 1 550 nm at – 60°C to + 85°C : ≤ 0.05 dB/km

3.4.1.6.2 *Temperature — Humidity cycling (Test method IS/IEC 60793-1-1 : 2008)* Induced attenuation at 1 310 nm and 1 550 nm at – 10°C to + 85°C : ≤ 0.05 dB/km and 95 percent relative humidity.

3.4.1.6.3 *Water immersion 23°C (Test method IS/IEC 60793-1-1 : 2008)*

Induced attenuation at 1 310 nm and 1 550 nm due to water immersion at 23 ± 2°C : ≤ 0.05 dB/km

3.4.1.6.4 *Accelerated aging (Temperature) 85°C (Test method IS/IEC 60793-1-1 : 2008)*

Induced attenuation at 1310 nm and 1550 nm due to temperature aging at 85 ± 2°C : ≤ 0.05dB/km

3.4.1.7 *Macro bend losses*

Fibre macro bend for G.657.A2 (Test method FOTP–62/ IEC-60793-1-47)

a) Change in attenuation when fibre is coiled with 10 turns on 15 mm radius mandrel : ≤ 0.03 dB at 1 550 nm
   : ≤ 0.10 dB at 1 625 nm
b) Change in attenuation when fibre is coiled 1 turn around 10 mm radius mandrel : ≤ 0.1 dB at 1 550 nm
   : ≤ 0.2 dB at 1 625 nm
c) Change in attenuation when fibre is coiled 1 turn around 7.5 mm radius mandrel : ≤ 0.3 dB at 1 550 nm
   : ≤ 0.7 dB at 1 625 nm

3.4.2 *Type of Fibre* — ITU-T G.657. B3

3.4.2.1 *Geometrical characteristics*

a) MFD at 1 310 nm : 8.6-8.8 µm + 0.4 µm
b) Nominal cladding diameter : 125 µm ± 0.7µm
c) Cladding non-circularity : ≤ 0.8 percent
d) Core clad concentricity error : ≤ 0.5 µm
e) Diameter over primary coated with : 242 µm ± 10 µm (un colour)
   double UV cured acrylate : 252 µm ± 10 µm (colour)
f) Coating/Cladding concentricity : ≤ 12 µm

3.4.2.2 *Transmission characteristics*

Cabled fibre attenuation

a) At 1 310 nm : ≤ 0.38 dB/km
b) At 1 383 nm : ≤ 0.38 dB/km
c) At 1 550 nm : ≤ 0.25 dB/km

NOTE — Point discontinuity in attenuation shall be less than 0.1 dB at 1 310 nm and 1 550 nm.

3.4.2.3 *Dispersion*

a) Zero dispersion slope : ≤ 0.092 ps/(nm^2 Km)
b) Zero dispersion wave length range : 1300-1350 nm
c) Chromatic dispersion at 1550 nm : ≤ 18.0 ps/nm. km
d) Polarization mode dispersion:
   1) Individual cabled fibre : ≤ 0.3 ps/√ km
   2) Link design value : ≤ 0.2 ps/√km

NOTE — Measurement on un-cabled fibre may be used to generate cabled fibre statistics and correlation is established.

3.4.2.4 *Cable cut off wavelength* — ≤ 1 260 nm

3.4.2.5 *Mechanical Characteristics*

3.4.2.5.1 *Proof test for minimum strain level* — 1 percent (Test method IEC-60793-1-30)

3.4.2.5.2 *Peak stripability force to remove primary* — 1.3 ≤ F ≤ 8.9 N coating of the fibre (Test method IS/IEC-60793-1-32 : 2010)

3.4.2.5.3 *Dynamic tensile strength (Test method IS/IEC-60793-1-31 : 2010)*

a) Un-aged (Median value) : ≥ 550 KPSI (3.80 GPa)
b) Aged (Median value) : ≥ 440 KPSI (3.00 GPa)

3.4.2.5.4 *Dynamic fatigue (Test method IS/IEC 60793-1-33 : 2001, method A/B)* : ≥ 20

3.4.2.5.5 *Static fatigue (Test method IEC-60793-1-33 : 2001)* : ≥ 20

3.4.2.5.6 *Fibre curl (Test method IS/IEC 60793-1-34 : 2006)* : ≥ 4 M

3.4.2.6 *Environmental characteristic of fibre*

3.4.2.6.1 *Operating temperature (Test method IS/IEC 60793-1-1: 2008)*

a) Temperature dependence of attenuation — – 60°C to + 85°C

b) Induced Attenuation at 1 310 nm and 1 550 nm at – 60°C to + 85°C ≤ 0.05 dB/km

3.4.2.6.2 *Temperature — Humidity cycling (Test method IS/IEC 60793-1-1 : 2008)*

Induced attenuation at 1 310 nm and 1 550 nm at – 10°C to + 85°C : ≤ 0.05 dB/km and 95 percent relative humidity.

3.4.2.6.3 *Water immersion 23°C (Test method IS/IEC 60793-1-1 : 2008)*

Induced attenuation at 1 310 nm and 1 550 nm due to water immersion at 23 ± 2°C : ≤ 0.05 dB/km

3.4.2.6.4 *Accelerated aging (Temperature) 85°C (Test method IS/IEC 60793-1-1: 2008)*

Induced attenuation at 1 310 nm and 1 550 nm due to temperature aging at 85 ± 2°C : ≤ 0.05dB/km

3.4.2.7 *Macro bend losses*

Fibre macro bend loss for G.657.B3 (Test method FOTP–62/IEC-60793-1–47):

a) Change in attenuation when fibre is coiled : ≤ 0.03 dB at 1 550 nm
with 1 turn on 10 mm radius mandrel : ≤ 0.10 dB at 1 625 nm

b) Change in attenuation when fibre is coiled : ≤ 0.08 dB at 1 550 nm
1 turn around 7.5 mm radius mandrel : ≤ 0.25 dB at 1 625 nm

c) Change in attenuation when fibre is coiled : ≤ 0.1 dB at 1 550 nm
1 turn around 5 mm radius mandrel : ≤ 0.3 dB at 1 625 nm

3.5 Optical Fibre Cable Construction Specifications for FTTH Indoor (Type I)

The cable shall be designed to the parameters mentioned in Annex A. The manufacturer shall submit designed calculation and the same shall be studied and checked.

3.5.1 *Cable Description*

The single mode colour coated fibres, Aramid Reinforced Plastic (ARP) rods are embedded in the sheath of low smoke zero halogen (LSZH) which protects the fibre from damage. The notch is provided at the mid-point in sheath to separate the fibres easily.

3.5.2 *Number of Fibres* — 1 or 2

3.5.3 *Strength Member*

The strength member in the cable shall provide the strength and flexibility to the cable and shall have anti buckling properties. The two numbers of solid ARP rods shall be used for the strength. The specification of ARP rod shall be as per Annex A.

3.5.4 *Outer Jacket*

A sheath of LSZH white in colour shall be provided. The colour shall conform to Munsell colour standards. The sheath shall be smooth, free from pin holes, joints, scratches, mended pieces and other defects, etcetra.

3.5.5 *Cable Parameter*

The manufacturer shall define all the cable parameters. The parameters of finished cable shall be as per Annex A.

3.6 Mechanical Characteristics and Tests on Optical Fibre Cable (Type I)

All observations shall be taken at 1 310 nm and 1 550 nm wavelengths. The attenuation of any fibre, after any of the tests shall not increase more than 0.1 dB for both 1310 nm and 1 550 nm wavelengths.

3.6.1 *Tensile Strength Test*

a) **Objective** — To test the tensile strength of FTTx optical fibre cable, in order to examine the behavior of the attenuation as a function of the load on a cable.

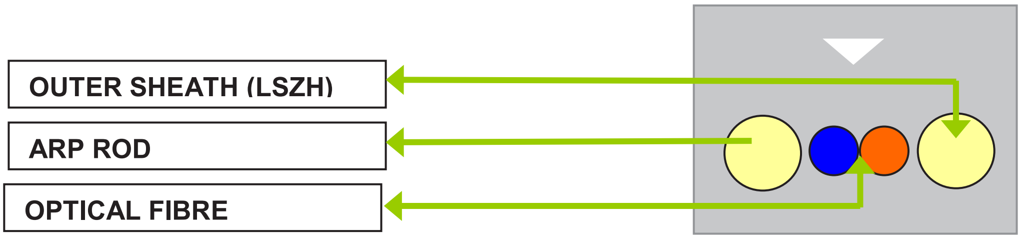

FIG. 1 TYPICAL STRUCTURAL

b) **Method** — *See* IS/IEC 60794-1-2 : 2003

c) **Test Specs** — The cable shall have sufficient strength to withstand a load of value T(N) = 9.81 × 1 W Newton (where, W = mass of 1 Km of cable, in Kg) or 100 N whichever is higher. The load shall be sustained for 10 min and the strain on the fibre and the attenuation shall be monitored.

d) **Requirement** — The load shall not produce a strain exceeding 0.6 percent in the fibre and shall not cause any permanent physical or optical damage to any component of the cable. The attenuation shall be noted before strain and after the release of strain

3.6.2 *Crush Test (Compressive Test)*

a) **Objective** — The purpose of this test is to determine the ability of an optical fibre cable to withstand crushing.

b) **Method** — *See* IS/IEC 60794-1-2 : 2003.

c) **Test Specs** — The fibres and component parts of the cable shall not suffer permanent damage when subjected to a compressive load of 500 Newton applied, between the plates of dimension 100 × 100 mm. The load shall be applied for 60 s. The attenuation shall be noted before and after the completion of the test.

d) **Requirement** — As mentioned above in clause **3.6.1 (d)**.

3.6.3 *Impact Test*

a) **Object** — The purpose of this test is to determine the ability of an optical fibre cable to withstand impact.

b) **Method** — *See* IS/IEC 60794-1-2 : 2003.

c) **Test Specs** — The cable shall have sufficient strength to withstand an impact caused by a mass weight of 5 Newton, when falls freely from a height of 70 mm. The radius, R of the surface causing impact shall be 100 mm, ten such impacts shall be applied at the same place. The attenuation shall be noted before and after the completion of the test.

d) **Requirement** — As mentioned above in clause **3.6.1 (d)**.

3.6.4 *Cable Bend Test*

a) **Objective** — The purpose of this test is to determine the ability of an optical fibre cable to withstand repeated flexing. The procedure is designed to measure optical transmittance changes and requires an assessment of any damage occurring to other cable components.

b) **Method** — *See* IS/IEC 60794-1-2 : 2003.

c) **Test Specs** — The fibre and the component parts of the cable shall not suffer permanent damage when the cable is repeatedly wrapped and unwrapped 4 complete turns of 10 complete cycles around a mandrel having diameter of 40 mm. The attenuation shall be noted before and after the completion of the test.

d) **Requirement** — As mentioned above in clause **3.6.1 (d)**.

3.6.5 *Temperature Cycling*

a) **Objective** — To determine the stability behaviour of the attenuation of a cable subjected to temperature changes, which may occur during storage, transportation and usage.

b) **Method** — IS/IEC 60794-1-2 : 2003 (To be tested on standard cable length of drum)

c) **Test Specs** — The permissible temperature range of the cable for storage shall be from – 20°C to + 70°C and for operation – 20°C to + 70°C. The rate of change of temperature during the test shall be 1°C per minute approx. The cable shall be subjected to temperature cycling for 12 h at each temperature as given below:

   1) T_{A2} temp. : – 20°C
   2) T_{A1} temp. : – 10°C
   3) T_{B1} temp. : + 60°C
   4) T_{B2} temp. : + 70°C

   The test shall be conducted for 2 cycles at the above temperatures.

d) **Requirement** — As mentioned above in clause **3.6.1 (d)**

3.7 Optical Fibre Cable Construction Specifications for FTTH Outdoor/Indoor (Type II)

The cable shall be designed to the parameters mentioned in Annex B. The manufacturer shall submit designed calculation and the same shall be studied and checked.

3.7.1 *Cable Description*

3.7.1.1 *Fibre unit*

The single mode colour coated fibres, aramid reinforced plastic rods are embedded in the sheath of LSZH, which protects the fibre from damage. The notch is provided at the mid-point in sheath to separate the fibres easily.

3.7.1.2 *Messenger wire*

A messenger wire is provided along with fibre unit to support it and strengthen it so that it can be hanged.

3.7.2 *Number of Fibres* — 1 or 2

3.7.3 *Strength Member*

The strength member in the cable shall provide the strength and flexibility to the cable and shall have anti buckling properties. The two numbers of solid aramid

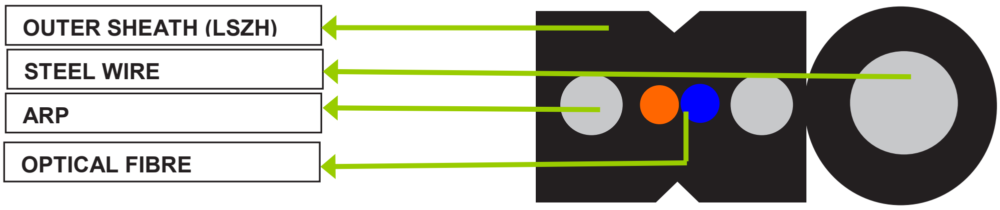

FIG. 2 TYPICAL STRUCTURAL DRAWING

reinforced plastic rod (ARP rod) shall be used for the strength. The specification of ARP rod shall be as per Annex B. A messenger wire is provided to provide additional strength.

3.7.4 *Outer Jacket*

A sheath of Low smoke zero halogen (LSZH) UV resistant black in colour shall be provided.

The colour shall conform to Munsell colour standards. The sheath shall be smooth, free from pin holes, joints, scratches, mended pieces and other defects, etc.

Method : *See* IS 10810 (Part 59): 1988, and IS 10810 (Part 63) : 1993.

3.7.5 *Cable Parameter*

The manufacturer shall define all the cable parameters. The parameters of finished cable shall be as per Annex B.

3.8 Mechanical Characteristics and Tests on Optical Fibre Cable (Type II)

All observations shall be taken at 1 310 nm, and 1 550 nm wavelengths. The attenuation of any fibre, after any of the tests shall not increase more than 0.1 dB for both 1 310 nm and 1 550 nm wavelengths.

3.8.1 *Tensile Strength Test*

a) **Objective** — To test the tensile strength of FTTH optical fibre cable, in order to examine the behavior of the attenuation as a function of the load on a cable.

b) **Method** — *See* IS/IEC 60794-1-2 : 2003.

c) **Test Specs** — The cable shall have sufficient strength to withstand a load of value

   T(N) = 9.81 × 1.3 W Newton (where, W = mass of 1 Km of cable, in Kg) or 400 N whichever is higher. The load shall be sustained for 10 min and the strain on the fibre and the attenuation shall be monitored.

d) **Requirement** — The load shall not produce a strain exceeding 0.6 percent in the fibre and shall not cause any permanent physical or optical damage to any component of the cable. The attenuation shall be noted before strain and, after the release of strain.

3.8.2 *Crush Test (Compressive Test)*

a) **Objective** — The purpose of this test is to, determine the ability of an optical fibre cable to withstand crushing.

b) **Method** — *See* IS/IEC 60794-1-2 : 2003.

c) **Test Specs** — The fibres and component parts of the cable shall not suffer permanent damage when subjected to a compressive load of 1 000 Newton applied, between the plates of dimension 100 × 100 mm. The load shall be applied for 60 s. The attenuation shall be noted before and after, the completion of the test.

d) **Requirement** — As mentioned above in clause **3.8.1 (d)**.

3.8.3 *Impact Test*

a) **Object** — The purpose of this test is to, determine the ability of an optical fibre cable to withstand impact.

b) **Method** — ***See*** IS/IEC 60794-1-2 : 2003.

c) **Test Specs** — The cable shall have sufficient strength to withstand an impact caused by a mass weight of 5 Newton, when falls freely from a height of 70 mm. The radius, R of the surface causing impact shall be 1 00 mm, ten such impacts shall be applied at the same place. The attenuation shall be noted before and after the completion of the test.

d) **Requirement** — As mentioned above in clause **3.8.1 (d)**.

3.8.4 *Cable Bend Test*

a) **Objective** — The purpose of this test is to determine the ability of an optical fibre cable to withstand repeated flexing. The procedure is designed to measure optical transmittance changes and requires an assessment of any damage occurring to other cable components.

b) **Method** — *See* IS/IEC 60794-1-2 : 2003 (Procedure-I).

c) **Test Specs** — The fibre and the component parts of the cable shall not suffer permanent damage when the cable is repeatedly wrapped and unwrapped 4 complete turns of 10 complete cycles around a mandrel having diameter of 40 mm. The attenuation shall be noted before and after the completion of the test.

d) **Requirement** — As mentioned above in clause **3.8.1 (d)**.

3.8.5 *Temperature Cycling*

a) **Objective** — To determine the stability behaviour of the attenuation of a cable subjected to temperature changes, which may occur during storage, transportation and usage.

b) **Method** — IS/IEC 60794-1-2 : 2003. (To be tested on Standard cable length of drum)

c) **Test Specs** — The permissible temperature range of the cable for storage shall be from – 20°C to + 70°C and for operation – 20°C to + 70°C. The rate of change of temperature during the test shall be 1° per minute approx. The cable shall be subjected to temperature cycling for 12 h at each temperature as given below:

   1) T_{A2} temp. : – 20°C
   2) T_{A1} temp. : – 10°C
   3) T_{B1} temp. : + 60°C
   4) T_{B2} temp. : + 70°C

   The test shall be conducted for 2 cycles at the above temperatures.

d) **Requirement** — As mentioned above in clause **3.8.1 (d)**.

4 MARKING

4.1 The cable shall carry the following information either stencilled on the reel or drum or contained in a label attached to it:

a) Reference to this Indian Standard;
b) Manufacturer’s name, brand name or trademark;
c) Type of cable;
d) Length of cable on the reel, drum or coil; and
e) Number of lengths on the reel, drum or coil (if more than one).

4.2 BIS Certification Marking

The Set-Top Box (STB) may also be marked with the Standard Mark.

4.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 2016 and the Rules and Regulation made thereunder. The details of the conditions under which the licence for use of the Standard Mark may be granted to manufacturers and producers may be obtained from the Bureau of Indian Standards.

ANNEX A

(*Clause* 3.5)

Type I Cable Parameters

ITEMS	DESCRIPTION
Number of fibres	1 or 2
Type of fibre	Single mode
Colour of fibres	Blue and orange
Strength members	Aramid reinforced plastic rod – 2 Numbers
Diameter of A.R.P. Rod	0.55 mm Nominal
Outer sheath material	Low Smoke Zero Halogen (L.S.Z.H.)
Outer Sheath Colour	White
Cable Dimensions	
Height(H)	2.0 ± 0.2 mm
Width(W)	3.1 ± 0.2 mm
Cable Weight	9.0 ± 1.0 Kg/Km

ANNEX B

(*Clause* 3.7)

Type II Cable Parameters

ITEMS	DESCRIPTION
Number of fibres	1 or 2
Type of fibre	Single mode
Colour of fibres	Blue and orange
Strength members	Aramid Reinforced Plastic Rod – 2 Numbers
Diameter of A.R.P. Rod	0.55 mm Nominal
Diameter of Messenger Wire	1.2 mm Nominal
Outer Sheath Material	Low Smoke Zero Halogen (L.S.Z.H.)
Outer Sheath Colour	Black
Cable Dimensions	
Height(H)	2.0 + 0.2 mm
Width(W)	5.2 + 0.2 mm
Cable Weight	20.0 + 2.0 Kg/Km

ANNEX C

(*Clause* 2)

LIST OF REFFERED INDIAN STANDARDS

IS No.	*Title*
IS 10810 (Part 59) : 1988	Methods of test for cables: Part 59 Determination of the amount of halogen acid gas evolved during combustion of polymeric materials taken from cables
IS 10810 (Part 63) : 1993	Methods of test for cables: Part 63 Smoke density of electric cables under fire conditions
IS/IEC 60793-1-1 : 2008	Optical fibres: Part 1 Measurement methods and test procedures, Section 1 General and guidance
IS/IEC 60793-1-30 : 2010	Optical fibres: Part 1 Measurement methods and test procedures, Section 30 Fibre proof test
IS/IEC 60793-1-31 : 2010	Optical fibres: Part 1 Measurement methods and test procedures, Section 31 Tensile strength
IS/IEC 60793-1-32 : 2010	Optical fibres: Part 1 Measurement methods and test procedures, Section 32 Coating strippability
IS/IEC 60793-1-33 : 2001	Optical fibres: Part 1 Measurement methods and test procedures, Section 33 Stress corrosion susceptibility
IS/IEC 60793-1-34 : 2006	Optical fibres: Part 1 Measurement method and test procedures, Section 34 Fibre curl
IS/IEC 60793-1-46 : 2001	Optial fibres: Part 1 Measurement methods and test procedures, Section 46 Monitoring of change in optical transmittance
IS/IEC 60794-1-2 : 2003	Optical fibre cables: Part 1 Generic specification, Section 2 Basic optical cable test procedures

ANNEX D

(*Clause* 2)

LIST OF REFERRED INTERNATIONAL STANDARDS

The Committee responsible for the formulation of this standard has reviewed the provisions of the international publications listed below and has decided that these may be used in conjunction with this standard till Indian Standards on these subjects are published

Reference No.	*Title*
ITU-T Rec. G.657	Characteristics of a bending-loss insensitive single-mode optical fibre and cable for the access network
EIA/TIA FOTP–62	IEC 60793-1-43 Measurement methods and test procedures
IEC 60794-1-21	Optical fibre cables — Part 1-21: Generic specification — Basic optical cable test procedures — Mechanical tests methods
IEC 60794-1-22	Optical fibre cables — Part 1-22: Generic specification — Basic optical cable test procedures — Environmental tests methods

ANNEX E

(Foreword)

COMMITTEE COMPOSITION

Fibre Optics, Fibres, Cables And Devices Sectional Committee, LITD 11

Organization	*Representative(s)*
Telecom Engineering Centre, New Delhi	Shri Bal Kishan ***(Chairman)***
Aksh Fibre, New Delhi	Shri Pawan Maheshwari Shri Anuj Maheshwari (*Alternate*)
Birla Ericsson Optical Ltd, Rewa (Madhya Pradesh)	Shri V P Singh Shri Narendra Jain (*Alternate*)
Component Approval Centre Telecommunication, Bengaluru	General Manager
Centre For Development of Telematics, New Delhi	Shri Atul Kumar Gupta
Central Electronics Engineering Research Institute, Chandigarh	Dr. Suchandan Pal
Central Glass And Ceramic Research Institute, Kolkatta	Dr. Ranjan Sen
Central Scientific Instruments Organization, Chandigarh	Dr. R.K.Sinha Shri Samir Mondal (*Alternate*)
Department Of Science And Technology, New Delhi	Shri Sanjay Bajpai
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Himachal Futuristic Company Limited, Gurugram	Shri Pramod Agrawal Shri Neeraj Ahuja (*Alternate*)
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This Indian Standard has been developed from Doc No.: LITD 11 (10336).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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Published by BIS, New Delhi